Fabrication, characterization, and functionalization of single-walled carbon nanotube conjugated with tamoxifen and its anticancer potential against human breast cancer cells

ABSTRACT

In this experiment, we aimed to fabricate SWCNT conjugated with tamoxifen and evaluated its anticancer potential against human breast cancer cells (MCF-7). The results showed that SWCNT was synthetized successfully using chemical vapor deposition (CVD) method. The results of Raman spectroscopy, SEM, and TEM analyses confirmed the synthesis of highly pure SWCNT. The functionalization of SWCNT was performed by oxidizing of SWCNT, attachment of polyethylene glycol (PEG) to oxidized SWCNT, and attachment of azelaic acid to the polyethylene glycol group. As a result, the SWCNT with free functional carboxylic acid and hydroxyl groups (SWCNT-PEG) was developed. The SWCNT-PEG was then conjugated with tamoxifen (SWCNT-PEG-TAM). The FT-IR together with NMR results confirmed the conjugation of tamoxifen to functionalized SWCNT (SWCNT-PEG-TAM). The cytotoxic concentrations (CC50) of SWCNT-PEG, tamoxifen, and SWCNT-PEG-TAM were >100, , and μg/ml, respectively. Linking tamoxifen to functionalized SWCNT enhanced the cytotoxic action of tamoxifen against breast cancer cells up to 2.3 times. The results of the morphological examination and caspase-3 activity confirmed the higher cytotoxic action of SWCNT-PEG-TAM as compared to free tamoxifen. The results obtained in this study indicated that this delivery system enhanced the therapeutic effects and anticancer potential of tamoxifen against human breast cancer cells.

Keyword: Single-walled carbon nanotube; Tamoxifen; Anticancer; Human breast cancer cells